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SOFTWARE METRICS
CAPABILITY EVALUATION
GUIDE

October, 1995

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1. INTRODUCTION

In its role as an agent for improving software technology use within the U.S. Air Force, the Software Technology Support Center (STSC) is supporting metrics technology improvement activities for its customers. These activities include: disseminating information regarding the U.S. Air Force Policy on software metrics [AP93M-017], providing metrics information to the public through CrossTalk, conducting customer workshops in software metrics, guiding metrics technology adoption programs at customer locations, researching new and evolving metrics methodologies, etc.

Helping customers become proficient in developing and using software metrics to support their software development and/or management activities is crucial to customer success. The STSC metrics support activities must be tailored to the customer's needs to ensure

a.   that the activities are appropriate to the customer's organization and metrics capability maturity, and[1]

b.   that the customer is ready to make improvements based on the support obtained.

Customer support needs include activities based on their apparent metrics capability and those that are particularly focused on dealing with the organizational and cultural issues that often need to be addressed to facilitate change.

This guide covers the following:

a.   It defines a metrics capability evaluation method that deals specifically with defining a customer's metrics capability.

b.   It presents metrics capability questionnaires that help gather metrics capability data.

c.   It outlines a metrics capability evaluation report that provides the basis for developing a metrics customer project plan.

d.   It provides a metrics customer profile form used to determine the initial information required to prepare for a metrics capability evaluation.

e.   It provides a customer organization information form that helps guide the STSC in gathering cultural information about the organization that will help with developing and implementing the metrics customer project plan.

2. EVALUATION APPROACH

2.1 Background

The foundation for the evaluation method is "A Method for Assessing Software Measurement Technology."[DASK90][2]   Metrics capability maturity consists of 5 maturity levels that are analogous to

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[1]   Metrics capability maturity (or metrics capability) refers how well an organization uses metrics to help manage and control project performance, product quality, and process implementation and improvement. This concept is discussed in more detail in [DASK90].

the software Capability Maturity Model (CMM) levels defined by the Software Engineering Institute (SEI).[PAUL93] This guide has been designed to cover metrics capability maturity Levels 1 through 3. When metrics capability evaluations show a strong percentage (e.g., 25 percent or more) of organizations at metrics capability maturity Level 3, the scope of the evaluation (and this guide) will be expanded to cover metrics capability maturity Levels 4 and 5.

This guide defines a set of questions to elicit information that will help characterize an organization's metrics capability. The themes used in the questionnaire and their relationships to an organization's metrics capability maturity (for Levels 1 through 3) are shown in Appendix A.

The guide contains two metrics capability questionnaires (one for acquisition organizations and one for software development/maintenance organizations). The questions in the questionnaires are used as the basis for interviews with an organization's representative(s) to help determine their metrics capability maturity. After the interviews are complete, the results are collated and reported in a evaluation report that is delivered to the evaluated organization. Additional work with the evaluated organization will depend on the organization's needs. Section 2.2 discusses the evaluation process. Appendix B contains a brief metrics customer profile form, which is filled out as a precursor to the metrics capability evaluation. Appendix C is an annotated outline of the metrics capability evaluation report, and Appendix D contains the customer organization information form.

2.2 Software Metrics Capability Evaluation Process

The software metrics capability evaluation process consists of the three basic parts:

a. An initial contact, which is performed when it is determined that an organization needs and wants assistance with its metrics capability.

b. The evaluation interview, which is the central activity in the software metrics capability evaluation process.

c. Collating and analyzing the results, which are the transition activities that occur between the evaluation interview and evaluation follow-up.

These sets of activities are discussed in Paragraphs 2.2.1 through 2.2.3.

In addition to evaluation, there may be follow-up activities. These include more detailed work with the customer that will provide a metrics capability improvement strategy and plan when applicable. Paragraph 2.3 discusses the follow-up activities.

2.2.1 Initial Contact

The initial contact with a customer generally is set up through an STSC customer consultant. The customer consultant briefs an assigned member of the STSC metrics team regarding a customer's need for a metrics capability evaluation and provides a contact for the metrics team member at the customer's site.

The metrics team member contacts the customer by phone to gain an initial understanding of the customer's organization and to set up the evaluation interview. The metrics customer profile form is used

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[2] The assessment method defined in [DASK90] was based on the Software Engineering Institute (SEI) process assessment methodology, which is currently exemplified in the *Capability Maturity Model (CMM) for Software*, Version 1.1. [PAUL93]

to help gather that information. Information collected during this initial contact will be used to help determine the proper approach for the introduction briefing presented during the evaluation interview visit. Only the point of contact information must be completed at this time; however, it is highly desirable to include the STSC business information. When the profile is not completed during the initial contact, it needs to be completed prior to (or as an introduction to) the evaluation interview at the customer's site.

2.2.2   Evaluation Interview

Two STSC metrics team members conduct the interviews as a metrics evaluation team. On the same day as the evaluation interview, an introduction briefing is provided to key people within the organization (to be determined jointly by the evaluation team members, the customer consultant assigned to the organization, and the organization's primary point of contact). The purpose of the briefing is to manage customer expectations. This is accomplished, in part, by providing education with respect to:

> a.   The concepts of metrics maturity.
>
> b.   The approach of the metrics evaluation team.
>
> c.   What to expect when evaluation results are provided.

The interviews are conducted with the manager most closely associated with the software development activities for the program (or project) under question.[3]   One other representative from the program (or project) should participate in the interview (a staff member responsible for metrics analysis and reporting would be most appropriate). The first part of the interview is to complete the metrics customer profile. When this is completed, the metrics capability questionnaire most related to the organization (either acquirer or development/maintenance organization) is used as the input to the remainder of the evaluation process. The questionnaire sections for both Levels 2 and 3 are used regardless of the customer's perceived metrics capability.

The questions in the metrics capability evaluation questionnaires have been formalized to require answers of yes, no, not applicable (NA), or don't know (?). If an answer is yes, the customer needs to relate examples or otherwise prove performance that fulfills the question. If the answer is no, comments may be helpful but are not required. (If the answer is don't know, a no answer is assumed.) If the answer is NA and it can be shown to be NA, the question is ignored and the answer is not counted as part of the score. The chosen metrics capability evaluation questionnaires need to be completed before the interview is considered complete.

An evaluation interview should not take more than one day for one program (or software project). If an organization is to be assessed, a representative sample of programs (or software projects) need to be assessed and each requires a separate interview.

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[3]   In the case of the acquirer, this will be the individual responsible for overseeing the software development organization. In the case of a development or maintenance organization, this will be the software project manager.

2.2.3   Collating and Analyzing the Results

The metrics capability questionnaires completed during the interview(s) and their associated examples (or other evidence of metrics capability maturity, see Paragraph B.1) are collated and returned to STSC for analysis. The metrics capability evaluation team that conducted the interview(s) is responsible for analyzing and reporting the results. An assessed program (or software project) is at Level 2 if at least 80% of all Level 2 questions are answered yes. Otherwise the organization is at Level 1, etc. [DASK90] (Scoring is discussed in more detail in Paragraph B.1. The contents of the metrics capability evaluation report are outlined in Appendix C.)

The questions in the metrics capability questionnaires are organized by metrics capability maturity themes to help focus the interviews and the results analysis. (The themes, as defined in [DASK90], and their characteristics at metrics capability maturity Levels 2 and 3 are reported in Appendix A.) The customer's strengths and weaknesses can be addressed directly with the information gathered during the interview session(s). In addition, activities for becoming more effective in implementing and using metrics can be highlighted in the metrics capability evaluation report and in the project plan.

2.3   Software Metrics Capability Evaluation Follow-up

Software metrics capability evaluation follow-up includes two sets of activities:

        a.   The metrics capability evaluation report.

        b.   The project plan and implementation.

The report details the evaluation results and provides recommendations for an initial set of improvement activities.

The project plan consists of a customer approved, detailed plan to improve the customer's metrics capability (which may include other aspects of support to the customer such as software process definition, project management support, or requirements management workshops, etc.).

The customer's organizational culture is important in developing the content and phasing of the project plan. Issues such as ability to incorporate change into the organization, management commitment to software technology improvement, etc., often need to be addressed in developing a success-oriented plan.[4]

Metrics capability improvement implementation consists of the physical implementation of the project plan and a periodic evaluation of the customer's status to determine the program's improvement and any required modifications to the plan. The project plan and implementation are described in Paragraph 2.3.2.

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[4]   Appendix D contains an organization information form the STSC uses to help define cultural issues that need to be addressed in the project plan.

2.3.1   Metrics Capability Evaluation Report

The metrics capability evaluation report consists of two parts:

      a.   The analyzed results of the evaluation.

      b.   Recommendations for a set of activities that will help improve the customer's metrics capability.

The results portion of the report is organized to discuss the customer's overall software metrics capability and to define the areas of strengths and weaknesses based on each of the measurement themes. The recommendations portion of the report describes an overall improvement strategy that provides a balanced approach toward metrics capability improvement based on the customer's current evaluation results. Appendix C contains an annotated outline of the report.

2.3.2   Project Plan and Implementation

If a customer has the interest to proceed with a project plan, the STSC will develop the plan in conjunction with the customer. The contents of the project plan, the estimates for plan implementation, and the schedule will be developed specifically for each customer's needs. Due to the possible variations in customer needs, it is difficult to determine the exact contents of the plan. At a minimum, the project plan contains the following information:

      a.   An executive overview, which includes a synopsis of the customer's current software metrics capability maturity and a general outline of the plan to be implemented.

      b.   Organizational responsibilities for the customer, the customer's interfacing organizations (e.g., a contractor), and the STSC. Issues that arise based on organizational information are highlighted.

      c.   Improvement objectives.

      d.   A set of activities to support improvement [e.g., a Work Breakdown Structure (WBS)] and a description of the activities' interrelationships.

      e.   A schedule for implementation and for periodic evaluation of the customer's progress. (The periodic evaluation may be implemented as additional metrics capability evaluations, as described in this guide.)

      f.   Effort and cost estimates for STSC support.

      g.   Facility requirements for training and other activities.

      h.   Descriptions of STSC products to be delivered as part of the improvement implementation.

After the plan is approved, the metrics capability improvement implementation follows the plan. The periodic evaluations of the customer's products provide feedback regarding the customer's progress and an opportunity to revise the plan if the improvement is not proceeding according to the plan. In this way, the plan and implementation process can be adjusted as necessary to support the customer's ongoing needs.

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                   Method for Assessing Software Measurement Technology," *Quality
                   Engineering*, Vol. 3, No. 1, 1990 to 1991, pp. 27 to 40.

PAUL93   Paulk, Mark C., et al., *Capability Maturity Model for Software*, Version 1.1,
                   CMU/SEI-93-TR-24, ESC-TR-93-177, February 1993.

SEI94   *Software Process Maturity Questionnaire*, CMM, Version 1.1, April 1994.

APPENDIX A.   MEASUREMENT THEMES AND RELATIONSHIPS

Table A-1 shows the six metrics themes and relates the themes to software metrics capability maturity
Levels 1 through 3.

Table A-1. Themes and Levels of Software Metrics Capability Maturity.[5]

Theme	Initial (Level 1)	Repeatable (Level 2)	Defined (Level 3)
1. Formalization of development process	Process unpredictable Project depends on seasoned professionals No/poor process focus	Projects repeat previously mastered tasks Process depends on experienced people	Process characterized and reasonably understood
2. Formalization of metrics process	Little or no formalization	Formal procedures established Metrics standards exist	Documented metrics standards Standards applied
3. Scope of metrics	Occasional use on projects with seasoned people or not at all	Used on projects with experienced people Project estimation mechanisms exist Metrics have project focus	Goal/Question/Metric package development and some use Data collection and recording Specific automated tools exist in the environment Metrics have product focus
4. Implementation support	No historical data or database	Data (or database) available on a per project basis	Product-level database Standardized database used across projects
5. Metrics evolution	Little or no metrics conducted	Project metrics and management in place	Product-level metrics and management in place
6. Metrics support for mgmt control	Management not supported by metrics	Some metrics support for management Basic control of commitments	Product-level metrics and control

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[5]   The information in this table has been extracted directly from [DASK90].

APPENDIX B. SOFTWARE METRICS CAPABILITY QUESTIONNAIRES

This appendix contains scoring information for the software metrics capability evaluations along with copies of the metrics customer profile form and the two software metrics capability evaluation questionnaires.

The metrics customer profile form helps gather general customer information for choosing the metrics capability evaluation questionnaire and for defining the contents of the project plan. The two software metrics capability evaluation questionnaires are as follows:

a. An acquisition organization questionnaire. The focus of this questionnaire is to determine the metrics capability level of a software acquisition organizations.

b. A software development/maintenance organization questionnaire. The focus of this questionnaire is to determine the metrics capability level of software development or maintenance organizations.

B.1 Use of Questionnaires and Scoring

B.1.1 Use of Questionnaires

These two metrics capability evaluation questionnaires provide the contents of the evaluation interviews described in Paragraph 2.2.2. The questions from the questionnaires are asked as written. The questions for Levels 2 and 3 are used for all interviews. The comments for each question are used to point to examples and other evidence of metrics capability maturity based on the activities referred to in the question. The answers to the questions and the examples and comments are the inputs to the scoring activity presented in Paragraph B.1.2.

B.1.2 Scoring

Scoring from the two metrics capability evaluation questionnaires is relatively simple:

a. If the answer to a question is yes, then proof of conformance needs to be shown to ensure that the customer has performed the activity(ies) indicated in the question. Proof of conformance includes:

1. Metrics standards for the organization.

2. Software acquisition plans, development plans, or contract statements that incorporate metrics requirements.

3. Meeting minutes or other items that indicate use of metrics.

4. Examples of database outputs.

5. Concurrence given by two or more individuals from the same organization who are interviewed separately.

6. Informal notes.

7. Briefing charts from management evaluations.

8. etc.

b. If the answer is no, or don't know, then the answer is scored as no.

c.   If the answer is NA, then question is subtracted from the total number of questions for that maturity level and the answer is not included in the overall score.

d.   When 80% or more of the Level 2 questions are answered yes (with proof), then the organization is considered to be a Level 2. Otherwise the organization is considered to be a Level 1.

e.   If the organization is a Level 2 and also answers 80% or more of the Level 3 questions yes (with proof), then the organization is considered to be a Level 3. Otherwise, the organization is considered to be a Level 1 or 2 as indicated in Item d.

The organization's metrics capability level, as indicated from the scoring process, the proofs of conformance, and comments are all used as inputs to the metrics capability evaluation report. Appendix C contains an annotated outline of a metrics capability evaluation report.

B.2   **Metrics Customer Profile Form**

1.   Point of Contact information:

    a.   Name: _____

    b.   Position: _____

    c.   Office symbol: _____

    d.   Location: _____

    e.   Phone #: _____   DSN: _____

    f.   Fax number: _____

    g.   Email address: _____

    h.   Organization name: _____

    i.   Products: _____

2.   Environment information:

    a.   Hardware platform: _____

    b.   Languages used: _____

    c.   Tools used for metrics: _____

3.   Organization information:

    a.   Major command (ACC, AFMC, AETC, AMC, other: _____)

    b.   Copy of organization chart (At least name and rank of commanding officer):

        _____

    c.   Type(s) of software (real time, communication, command & control, MIS, other):

        _____

    d.   Type(s) of activity (development, acquisition, maintenance, combination, other):

        _____

e.   Are project teams comprised of members from more than one organization? (If yes, please give examples) _____

_____

f.   Typical size of development organization for a particular program (or project) (less than 10, 10-40, more than 40 personnel): _____

_____

g.   Typical length of project (< 6 mo, 6 - 18 mo, 18 mo - 3 yr, > 3 yr): _____

4.   General background:

a.   What are the organization's strengths? _____

_____

b.   Can you demonstrate these strengths through measurements or other objective means? (if yes, examples?): _____

_____

c.   What are the organization's biggest challenges? _____

_____

d.   Have measurements or other objective means been used to understand or to help manage these challenges? (if yes, examples?): _____

_____

5.   Metrics background:

a.   Does your organization require Software Development Plans to be developed and used?

b.   Are project management tools used? (examples?): _____

_____

c.   How is project status reported? (examples?): _____

_____

_____

d.   How is product quality reported? (examples?): _____

_____

_____

e.   What forces are driving metrics interest in your organization (SAF/AQ, CO, self, etc.)? _

6.   STSC business information:

a.   Has the organization received STSC information or services?

    1.   CrossTalk? _____

    2.   Technology Reports? _____

    3.   Workshops? _____

    4.   Consulting? _____

b.   Does the organization need help? _____

c.   Does the organization want help? _____

d.   The organization would like help with (describe): _____

_____

e.   How well is the organization funded for new technology adoption (including training)?

    1.   Are there funds to pay for STSC Products and Services? _____

    2.   Is the organization *willing* to pay? _____

f.   Are their needs/wants a match to STSC products and services? _____

B.3   Acquisition Organization Questionnaire[6]

B.3.1   Questions for Metrics Capability Level 2

B.3.1.1   Theme 1: Formalization of Source Selection and Contract Monitoring Process

#	Question	Yes	No	NA	?
1a	Is a Software Capability Evaluation (SCE) or Software Development Capability Evaluation (SDCE) for developers part of your source selection process?[7] Comments:	☐	☐	☐	☐
1b	Is proof of a specific CMM Level required from developers as part of your source selection process? Comments:	☐	☐	☐	☐
2	Does your organization require and evaluate developers' draft software development plans as part of the source selection process? Comments:	☐	☐	☐	☐
3	Are software metrics required as part of developers' software development plans (or other contractually binding metrics plans)? Comments:	☐	☐	☐	☐

---

[6]   Throughout these questionnaires, acquirer refers to an organization that acquires software or systems. Developer refers to an organization that develops or maintains software or systems for an acquirer. (For example, a developer could refer to a non-military organization (e.g., a defense contractor, a university, etc.) that works under the terms of a legal contract; an external Government or Military organization that works under the terms of a Memorandum of Agreement (MOA); or an organic organization tasked with developing or maintaining software under an informal agreement, etc.) Contract refers to an agreement between the acquirer and the contractor, regardless of its actual form (e.g., an MOA).

[7]   Score only one correct for a yes response to either 1a or 1b. If neither is a yes answer, score only one no.

#	Question	Yes	No	NA	?
4	Are software cost and schedule estimates required from the developer as part of the source selection process?	☐	☐	☐	☐
	Comments:				
5	Is the developer's project performance monitored based on the cost and schedule estimates?	☐	☐	☐	☐
	Comments:				
6	Are the acquirers' management plans developed, used, and maintained as part of managing a program?	☐	☐	☐	☐
	Comments:				

B.3.1.2   Theme 2: Formalization of Metrics Process

#	Question	Yes	No	NA	?
1	Is there a written organizational policy for collecting and maintaining software metrics for this program?	☐	☐	☐	☐
	Comments:				
2	Is each program required to identify and use metrics to show program performance?	☐	☐	☐	☐
	Comments:				
3	Is the use of software metrics documented?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
4	Are developers required to report a set of standard metrics?	☐	☐	☐	☐

Comments:

B.3.1.3   *Theme 3: Scope of Metrics*

#	Question	Yes	No	NA	?
1	Are internal measurements used to determine the status of the activities performed for planning a new acquisition program?	☐	☐	☐	☐

Comments:

2	Are measurements used to determine the status of software contract management activities?	☐	☐	☐	☐

Comments:

3	Do(es) your contract(s) require metrics on the developer's actual results (e.g., schedule, size, and effort) compared to the estimates?	☐	☐	☐	☐

Comments:

4	Can you determine whether the program is performing according to plan based on measurement data provided by the developer?	☐	☐	☐	☐

Comments:

5	Are measurements used to determine your organization's planned and actual effort applied to performing acquisition planning and program management?	☐	☐	☐	☐

Comments:

#	Question	Yes	No	NA	?
6	Are measurements used to determine the status of your organization's software configuration management activities?	☐	☐	☐	☐

Comments:

B.3.1.4   Theme 4: Implementation Support

#	Question	Yes	No	NA	?
1	Does the program (or project) have a database of metrics information?	☐	☐	☐	☐

Comments:

2	Do you require access to the contractor's metrics data as well as completed metrics reports?	☐	☐	☐	☐

Comments:

3	Does your database (or collected program data) include both developer's and acquirer's metrics data?	☐	☐	☐	☐

Comments:

B.3.1.5   *Theme 5: Metrics Evolution*

#	Question	Yes	No	NA	?
1	Is someone from the acquisition organization assigned specific responsibilities for tracking the developer's activity status (e.g., schedule, size, and effort)? Comments:	☐	☐	☐	☐
2	Does the developer regularly report the metrics defined in the developer's software development plan (or other contractually binding metrics plan)? Comments:	☐	☐	☐	☐
3	Do your contracts have clauses that allow the acquirer to request changes to the developer's metrics based on program needs? Comments:	☐	☐	☐	☐

B.3.1.6   *Theme 6: Metrics Support for Management Control*

#	Question	Yes	No	NA	?
1	Do you track your developer's performance against the developer's commitments? Comments:	☐	☐	☐	☐
2	Are the developer's metrics results used as an indicator of when contract performance should be analyzed in detail? Comments:	☐	☐	☐	☐
3	Are metrics results used to support risk management, particularly with respect to cost and schedule risks? Comments:	☐	☐	☐	☐

#	Question	Yes	No	NA	?
4	Are program acquisition and/or program management metrics used to help determine when changes should be made to your plans (e.g., changes to schedules for completion of planning activities and milestones, etc.)?	☐	☐	☐	☐

Comments:

5	Are measurements used to determine the status of verification & validation activities for software contracts?	☐	☐	☐	☐

Comments:

B.3.2   **Questions for Metrics Capability Level 3**

B.3.2.1   *Theme 1: Formalization of Source Selection and Contract Monitoring Process*

#	Question	Yes	No	NA	?
1	Do you require developers to show proof of software development maturity at a minimum of CMM Level 3?	☐	☐	☐	☐
	Comments:				
2	Is your software acquisition process reviewed for improvement periodically?	☐	☐	☐	☐
	Comments:				
3	Does your organization have a standard software acquisition process?	☐	☐	☐	☐
	Comments:				
4	Do one or more individuals have responsibility for maintaining the organization's standard software acquisition processes?	☐	☐	☐	☐
	Comments:				
5	Does the organization follow a written policy for developing and maintaining the acquisition process and related information (e.g., descriptions of approved tailoring for standards based on program attributes)?	☐	☐	☐	☐
	Comments:				

B.3.2.2 Theme 2: Formalization of Metrics Process

#	Question	Yes	No	NA	?
1	Do you have documented standards for metrics definitions and for reporting formats you require from developers?	☐	☐	☐	☐

Comments:

2	Are these standards tailorable to the size, scope, and type of the software to be acquired?	☐	☐	☐	☐

Comments:

3	Are specific metrics requested for each new acquisition based on your organization's metrics standards?	☐	☐	☐	☐

Comments:

4	Is someone from your organization assigned specific responsibilities for maintaining and analyzing the contractor's metrics regarding the status of software work products and activities (e.g., effort, schedule, quality)?	☐	☐	☐	☐

Comments:

B.3.2.3 Theme 3: Scope of Metrics

#	Question	Yes	No	NA	?
1	Do you collect, maintain, and report metrics data for all new (in the last 3 years) contracts?	☐	☐	☐	☐

Comments:

#	Question	Yes	No	NA	?
2	Do you use automated tools that support metrics collection, maintenance, and reporting?	☐	☐	☐	☐
	Comments:				
3	Do you and your developer(s) use automated metrics tools that allow you to share contract metrics data?	☐	☐	☐	☐
	Comments:				
4	During contract negotiations, do the program goals drive the metrics required for the contract?	☐	☐	☐	☐
	Comments:				
5	Do the metrics collected include specific product metrics (e.g., quality, reliability, maintainability)?	☐	☐	☐	☐
	Comments:				
6	Do you require metrics summary reports that show general program trends as well as detailed metrics information?	☐	☐	☐	☐
	Comments:				

B.3.2.4   Theme 4: Implementation Support

#	Question	Yes	No	NA	?
1	Does your program metrics database include information on specific product metrics (e.g., quality, reliability, maintainability)? Comments:	☐	☐	☐	☐
2	Do you share metrics data across programs? Comments:	☐	☐	☐	☐
3	Is the metrics data shared through a common organizational database? Comments:	☐	☐	☐	☐
4	Does your organization have a standard length of time that you retain metrics data? Comments:	☐	☐	☐	☐
5	Does the organization verify the metrics data maintained in the metrics database? Comments:	☐	☐	☐	☐
6	Does your organization manage and maintain the metrics database? Comments:	☐	☐	☐	☐

B.3.2.5   *Theme 5: Metrics Evolution*

#	Question	Yes	No	NA	?
1	Do you use product metrics in making management decisions? (e.g., a decision is made to delay schedule because of known defects).	☐	☐	☐	☐
	Comments:				
2	Are product metrics reported during program management reviews (e.g., defects by severity, or defects by cause)?	☐	☐	☐	☐
	Comments:				
3	Are both project and product metrics used in making management decisions regarding contract performance?	☐	☐	☐	☐
	Comments:				
4	Does your organization review the current metrics set periodically for ongoing usefulness?	☐	☐	☐	☐
	Comments:				
5	Does your organization review the current metrics set periodically to determine if new metrics are needed?	☐	☐	☐	☐
	Comments:				

B.3.2.6 *Theme 6: Metrics Support for Management Control*

#	Question	Yes	No	NA	?
1	Are measurements used to determine the status of the program office activities performed for managing the software requirements?	☐	☐	☐	☐
	Comments:				
2	Are product metrics used as an indicator for renegotiating the terms of contract(s) when necessary?	☐	☐	☐	☐
	Comments:				
3	Are product metrics used in reports forwarded to higher level management concerning contract performance?	☐	☐	☐	☐
	Comments:				
4	Are measurements used to forecast the status of products during their development?	☐	☐	☐	☐
	Comments:				
5	Are product metrics used as inputs to award fee calculations for cost plus award fee contracts?	☐	☐	☐	☐
	Comments:				
6	Do metrics serve as inputs for determining when activities need to be initiated (or modified) to mitigate technical program risks?	☐	☐	☐	☐
	Comments:				

B.4   Software Development/Maintenance Organization Questionnaire

B.4.1   Questions for Metrics Capability Level 2

B.4.1.1   Theme 1: Formalization of the Development Process

#	Question	Yes	No	NA	?
1a	Has your organization been assessed via the SEI CMM?[8] (This could be an independent assessment or an internal assessment supported by an SEI authorized source).	☐	☐	☐	☐
	Comments:				
1b	Has your organization been assessed via some vehicle other than the SEI CMM?	☐	☐	☐	☐
	Comments:				
2	Are software development plans developed, used, and maintained as part of managing software projects?	☐	☐	☐	☐
	Comments:				
3	Are software metrics included in your software development plans or other contractual binding document(s)?	☐	☐	☐	☐
	Comments:				
4	Does your organization have an ongoing software process improvement program?	☐	☐	☐	☐
	Comments:				

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[8]   Score only one correct for a yes response to either 1a or 1b. If neither is a yes answer, score only one no.

B.4.1.2   *Theme 2: Formalization of Metrics Process*

#	Question	Yes	No	NA	?
1	Is there a written policy for collecting and maintaining project management metrics (e.g. cost, effort, and schedule)?	☐	☐	☐	☐
	Comments:				
2	Do standards exist for defining, collecting, and reporting metrics?	☐	☐	☐	☐
	Comments:				
3	Is each project required to identify and use metrics to show project performance?	☐	☐	☐	☐
	Comments:				

B.4.1.3   *Theme 3: Scope of Metrics*

#	Question	Yes	No	NA	?
1	Are measurements used to determine the status of activities performed during software planning?	☐	☐	☐	☐
	Comments:				
2	Are measurements used to determine and track the status of activities performed during project performance?	☐	☐	☐	☐
	Comments:				
3	Does the project manager establish cost and schedule estimates based on prior experience?	☐	☐	☐	☐
	Comments:				

B.4.1.4   *Theme 4: Implementation Support*

#	Question	Yes	No	NA	?
1	Is there a project database of metrics information?	□	□	□	□
	Comments:				
2	Is the project manager reponsible for implementing metrics for the project?	□	□	□	□
	Comments:				
3	Do you keep metrics from project to project (historical data)?	□	□	□	□
	Comments:				

B.4.1.5   *Theme 5: Metrics Evolution*

#	Question	Yes	No	NA	?
1	Do you report the project's actual results (e.g., schedule and cost) compared to estimates?	□	□	□	□
	Comments:				
2	Is someone on the staff assigned specific responsibilities for tracking software project activity status (e.g., schedule, size, cost)?	□	□	□	□
	Comments:				
3	Do you regularly report the metrics defined in the software development plan or other contractually required document(s)?	□	□	□	□
	Comments:				

B.4.1.6 Theme 6: Metrics Support for Management Control

#	Question	Yes	No	NA	?
1	Do metrics results help the project manager manage deviations in cost and schedule?	☐	☐	☐	☐
	Comments:				
2	Are measurements used to determine the status of software configuration management activities on the project?	☐	☐	☐	☐
	Comments:				
3	Are measurements used to determine the status of software quality assurance activities on the project?	☐	☐	☐	☐
	Comments:				
4	Are measurements used to determine the status of the activities performed for managing the allocated requirements (e.g., total number of requirements changes that are proposed, open, approved, and incorporated into the baseline)?	☐	☐	☐	☐
	Comments:				
5	Are cost and schedule estimates documented and used to refine the estimation process?	☐	☐	☐	☐
	Comments:				
6	Do you report metrics data to the customer based on customer requirements?	☐	☐	☐	☐
	Comments:				

B.4.2 **Questions for Metrics Capability Level 3**

B.4.2.1 *Theme 1: Formalization of the Development Process*

#	Question	Yes	No	NA	?
1	Is your software development process reviewed for improvement periodically?	☐	☐	☐	☐
	Comments:				
2	Does your organization's standard software process include processes that support both software management and software engineering?	☐	☐	☐	☐
	Comments:				
3	Are your processes tailorable to the size/scope of the project?	☐	☐	☐	☐
	Comments:				

B.4.2.2 *Theme 2: Formalization of Metrics Process*

#	Question	Yes	No	NA	?
1	Do you have documented organizational standards for metrics (e.g., metrics definitions, analysis, reports, and procedures)?	☐	☐	☐	☐
	Comments:				
2	Are these standards tailorable to the size and scope of the software project?	☐	☐	☐	☐
	Comments:				
3	Are there standards established for the retention of metrics?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
4	Are specific project and product metrics proposed for each software project based on the organization's metrics standards?	☐	☐	☐	☐
	Comments:				
5	Is someone assigned specific responsibilities for maintaining and analyzing metrics regarding the status of software work products and activities (e.g., size, effort, schedule, quality)?	☐	☐	☐	☐
	Comments:				
6	Does the organization collect, review, and make available information related to the use of the organization's standard software process (e.g., estimates and actual data on software size, effort, and cost; productivity data; and quality measurements)?	☐	☐	☐	☐
	Comments:				

B.4.2.3   *Theme 3: Scope of Metrics*

#	Question	Yes	No	NA	?
1	Do the project/organization management and technical goals drive the metrics required?	☐	☐	☐	☐
	Comments:				
2	Do you collect, maintain, and report project and product metrics data for all projects?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
3	Do you use automated tools that support metrics collection, maintenance, and reporting?	☐	☐	☐	☐
	Comments:				
4	Do the metrics collected include specific product metrics (e.g., quality, reliability, maintainability)?	☐	☐	☐	☐
	Comments:				
5	Do you report product metrics (e.g., problem/defect density by product; amount of rework; and/or status of allocated requirements) throughout the development life cycle?	☐	☐	☐	☐
	Comments:				

B.4.2.4   Theme 4: Implementation Support

#	Question	Yes	No	NA	?
1	Does your metrics database include information on specific product metrics (e.g., quality, reliability, maintainability)?	☐	☐	☐	☐
	Comments:				
2	Do you share metrics data across software projects?	☐	☐	☐	☐
	Comments:				
3	Is the metrics data shared through a common organizational database?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
4	Does your organization have a standard length of time that you retain metrics data?	☐	☐	☐	☐
	Comments:				
5	Does your organization verify the metrics data maintained in the metrics database?	☐	☐	☐	☐
	Comments:				
6	Does your organization manage and maintain the metrics database?	☐	☐	☐	☐
	Comments:				
7	Have normal ranges been established for project metrics reported (e.g., the difference between planned and actual schedule commitments)?	☐	☐	☐	☐
	Comments:				

B.4.2.5   Theme 5: Metrics Evolution

#	Question	Yes	No	NA	?
1	Do you use product metrics as well as project metrics in making management decisions?	☐	☐	☐	☐
	Comments:				
2	Are product metrics as well as project metrics reported during program management reviews (e.g., the number of defects per SLOC)?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
3	Do you report metrics to your internal manager?	☐	☐	☐	☐
	Comments:				
4	Do you report metrics to your customer?	☐	☐	☐	☐
	Comments:				

B.4.2.6   *Theme 6: Metrics Support for Management Control*

#	Question	Yes	No	NA	?
1	Are product metrics as well as project metrics used as indicators for renegotiating the terms of contract(s) when necessary (e.g., you decide to extend a schedule based on the known number of defects in the product)?	☐	☐	☐	☐
	Comments:				
2	Do metric results help isolate technical problems?	☐	☐	☐	☐
	Comments:				
3	Are improvements to the metrics process (including metrics standards, procedures, definitions, etc.) based on analysis and lessons learned?	☐	☐	☐	☐
	Comments:				
4	Are measurements used to determine the quality of the software products (i.e., numbers, types, and severity of defects identified)?	☐	☐	☐	☐
	Comments:				

#	Question	Yes	No	NA	?
5	Do you maintain metrics specifically to help you manage your project?	☐	☐	☐	☐
	Comments:				
6	Are management decisions made as a result of metrics reported (e.g., is corrective action taken when actual results deviate significantly from the project's software plans)?	☐	☐	☐	☐
	Comments:				
7	Are metrics that are reported to the customer consistent with internally reported metrics?	☐	☐	☐	☐
	Comments:				

APPENDIX C.   SOFTWARE METRICS CAPABILITY EVALUATION REPORT: ANNOTATED OUTLINE

The goals of the software metrics capability evaluation report are as follows:

a.   Report the results of the evaluation. The results have two components:

     1.   General results (i.e., metrics capability Level and an overview of the organization's metrics-related strengths and weaknesses).

     2.   Discussion of the organization's strengths and weaknesses based on each of the six measurement themes identified in Appendix A.

b.   Discuss recommendations for improvement. These recommendations will be based on the results of the evaluation and may include one or more of several elements, such as:

     1.   A recommended set of high payback activities that the organization could use to implement metrics capability improvements.

     2.   Recommendations to implement a metrics improvement program that would be tailored to meet the specific organization's goals based on follow-up consulting and plan preparation. These recommendations would include a brief description of the areas to be covered in the metrics improvement program to help open communication with the organization.

     3.   Recommendations to implement other management and/or engineering improvement activities that would be tailored to meet the specific organization's objective based on follow-up consulting and plan preparation. These recommendations would include a brief description of the areas to be covered in the program to help open communication with the organization.

Figure C-1 is the annotated outline for the software metrics capability evaluation report.

1.   INTRODUCTION

1.1   Identification

Use the following sentence to identify the evaluation report: "This report provides the results of a software metrics capability evaluation given on (review dates, in mm/dd/yy format) for," then provide the organization's name, office symbol, location, and address. In addition, provide the approximate size of the organization appraised, the names and office symbols for any branches or sections that were represented from within a larger organization, the basic "type" of organization (i.e., acquisition, software development, software maintenance), and the number of individuals interviewed.

1.2   Introduction to the Document

Identify the document's organization and provide a summary of the information contained in each major section.

2.   APPRAISAL RESULTS

2.1   General Results

Give the metrics capability level for the organization, and provide backup for that result.

2.1.1   General Metrics Strengths

Provide a listing of general areas within the six metrics themes represented in the evaluation where the organization showed strengths, e.g., establishment and general use of a metrics database or general examples of management decision making based on metrics results.

2.1.2   General Metrics Weaknesses

Provide a listing of general areas within the six measurement themes represented in the evaluation where the organization showed weaknesses, e.g., no metrics database or identification of metrics from the Air Force metrics mandate that are not being collected or used.

2.2   Specific Areas for Improvement

2.2.1   Level 2 Areas for Improvement

2.2.1.X   Theme X Areas for Improvement

For each of the six measurement themes, provide a description of the weakness(es) for that theme. Include the following topics in that description:

**Figure C-1. Software Metrics Capability Evaluation Results and Recommendations Report:
Annotated Outline**

a. Weakness(es)

b. Discussion

c. Recommended action

2.2.2 *Level 3 Areas for Improvement*

2.2.2.X *Theme X Areas for Improvement*

For each of the six measurement themes, provide a description of the weakness(es) for that theme. Include the following topics in that description:

a. Weakness(es)

b. Discussion

c. Recommended action

3. RECOMMENDATIONS

Provide any general recommendations that resulted from analyzing the appraisal results, e.g., need to determine general management approach and commitment to change before charting a detailed metrics improvement plan, etc.

Give the background and rationale for the recommendations, and provide a set of positive steps the organization could take to improve their metrics capabilities. This section should be used as a place to recommend (or propose) possible first steps that the metrics customer and the STSC could explore to determine whether an ongoing relationship would be mutually beneficial. (In the case of metrics capability Level 1 organizations, examples are: to undertake a study of the organization's culture to determine the easy and high payback activities that would give the organization some positive results for minimal effort, to work with the organization's management to determine their commitment to change, etc. Other recommendations could include working with the STSC or another support organization to develop a project plan.)

APPENDICES

Appendix A contains the Measurement Theme and Relationships Table (Table A-1 herein). Also, if necessary, starting with Appendix B, provide background information (e.g., the customer profile, etc.) that would be difficult to incorporate in the main body of the report or that would interfere with the readability and understandability of the evaluation results.

**Figure C-1. Software Metrics Capability Evaluation Results and Recommendations Report:
Annotated Outline (Continued)**

APPENDIX D. ORGANIZATION INFORMATION FORM

It has been found that the organization's culture often is extremely important in determining how best to work for any type of software process improvement, including establishing a working metrics program. This appendix has been developed to elicit cultural information about the metrics customer that will help STSC develop the project plan and work with the customer for their metrics capability improvement.

Credibility:

1.   How would you characterize the organization's customer satisfaction?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

2.   How would you characterize the organization's ability to meet schedule commitments?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

3.   How would you characterize the organization's ability to meet budget commitments?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

4.   How would you characterize the organization's product quality?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

5.   How would you characterize the organization's staff productivity?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

6.   How would you characterize the organization's staff morale/job satisfaction?

   ☐ Excellent   ☐ Good   ☐ Fair   ☐ Poor

        Please explain: _____

7.   How frequently do the development projects have to deal with changes in customer requirements?

   ☐ Weekly or Daily   ☐ Monthly   ☐ Less Often   ☐ Rarely if Ever

        Please explain: _____

Motivation:

1. To what extent are there tangible incentives or rewards for successful metrics use?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

Please explain: _____

2. To what extent do technical staff members feel that metrics get in the way of their real work?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

Please explain: _____

3. To what extent have managers demonstrated their support for rather than compliance to organizational initiatives or programs?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

Please explain: _____

4. To what extent do personnel feel genuinely involved in decision making?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

Please explain: _____

5. What does management expect from implementing metrics?

Please explain: _____

Culture/Change History

1. To what extent has the organization used task forces, committees, and special teams to implement projects?

    ☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

    Please explain: _____

2. To what extent does "turf guarding" inhibit the operation of the organization?

    ☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

    Please explain: _____

3. To what extent has the organization been effective in implementing organization initiatives (or improvement programs)?

    ☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

    Please explain: _____

4. To what extent has previous experience led to much discouragement or cynicism about metrics?

    ☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

    Please explain: _____

5. To what extent are lines of authority and responsibility clearly defined?

    ☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

    Please explain: _____

<u>Organization Stability</u>

1. To what extent has there been turnover in key senior management?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

2. To what extent has there been a major reorganization(s) or staff down-sizing?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

3. To what extent has there been growth in staff size?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

4. How much turnover has there been among middle management?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

5. How much turnover has there been among the technical staff?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

<u>Organizational Buy-In</u>

1. To what extent are organizational goals clearly stated and well understood?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

 Please explain: _____

2. What level of management participated in the goal setting?

☐ Senior ☐ Middle ☐ First Line Mgt ☐ Don't Know

 Please explain: _____

3.   What is the level of buy-in to the goals within the organization?

☐ Senior Mgt   ☐ Middle Mgt   ☐ First Line Mgt   ☐ Individual   ☐ Don't know
                                                       Contributor

       Please explain: _____

4.   To what extent does management understand the issues faced by the practitioners?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

       Please explain: _____

5.   To what extent have metrics been used for improving processes?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

       Please explain: _____

6.   To what extent has there been involvement of the technical staff in metrics?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

       Please explain: _____

8.   To what extent do individuals whose work is being measured understand how the
       metrics are/will be used in the management process?

☐ Substantial   ☐ Moderate   ☐ Some   ☐ Little if any   ☐ Don't know

       Please explain: _____

<u>Measurement Knowledge/Skills</u>

1. How widespread is metrics knowledge/training?

☐ Substantial ☐ Moderate ☐ Some ☐ Little if any ☐ Don't know

Please explain: _____

2. What type of metrics training have members of the organization participated in?

☐ Statistical Process Control ☐ Data Analysis ☐ Metrics Application ☐ Basics ☐ Don't know

Other: _____